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SOME OF THE IMPLICATIONS OF THE ACQUISITION OF NUCLEAR WEAPONS BY THE SMALLER POWERS

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PREFACE

In the 16 years since the United States Government, at the behest of Professor Albert Einstein, set aside six thousand dollars for exploring the possibility of creating an atomic explosion, nuclear weapons are known to have come into the arsenals of three of the major nations of the world. These holdings have met with unparalleled attention from a world intensely concerned with their impact upon warfare and upon civilization itself.

Until lately, with nuclear weapons ostensibly confined to the Soviet Union, the United States and the United Kingdom, the world has known, in general, to which quarter to look for trouble from these ominous instruments of war and international blackmail. Recently, however, the extent and degree of nuclear activity has so expanded that nuclear weapon holdings seem on the verge of spilling over, with as yet unassessed complications, into many additional areas. There being three countries now known to possess nuclear weapons, this prospect is often referred to as the "fourth country" problem.

This paper examines this problem in terms of the practicability of acquisition of nuclear weapons by small and medium-sized nations and attempts to define the implications to the national security of the United States of ever-broadening possession of these weapons.

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SOME OF THE IMPLICATIONS OF THE ACQUISITION OF NUCLEAR WEAPONS BY THE SMALLER POWERS

Chapter I
THE ACQUISITION

In considering the implications of the spread of nuclear weapons, it is necessary to know what kind of weapons will become available, to whom, and in what quantity. Part of the answer to this derives from learning how a "fourth country" might come to possess such weapons. While one cannot engage in free flights of fancy on such an essentially logistical matter, still there would seem to be in this new and burgeoning field a fairly wide range of possibilities.

The Spectrum of Means

A glance will first be directed toward the question whether technology will ever progress to a point where nuclear weapons can be made cheaply and easily. Speculation is occasionally heard about the day when they can be constructed from "mud and straw" as nuclear science moves out of its infancy. A cursory exploration of this conjecture leads to the conclusion that the laws of physics are well enough known to ensure that a technological breakthrough in the production of the fissionable material for the weapons is probably not in the cards. True, new methods of isotope separation may ultimately be devised; yet research has been so exhaustive as to make remote the possibility of weapons material becoming available in the foreseeable future except by the means by which it is produced today. Hence, consideration of the methods by which a nation might acquire nuclear weapons will dwell primarily on two major possibilities.

a. Manufacture within the nation, by production methods now known.

b. Transfer by gift or sale from a nation possessing a number of nuclear weapons in excess of its own needs.

While there may not be radically new and easy ways in sight to produce fissionable material, a lesser nation would not need weapons of the sophistication and power of those of major nations, and hence it might be adequate for it to make a "sloppy" or "poor man's" bomb. Material of a less highly refined grade could be used, and a more primitive design could be employed; this fact, plus the need for fewer weapons, will tend to reduce a smaller nation's requirements for

production facilities. Manufacture within the "fourth country" -- made more likely through nuclear power programs--will be the path to nuclear arming initally explored.

Atoms for "Peace"

Even before the end of World War II the hazard of the potential diversion of fissionable materials from atomic power programs was considered sufficiently great to be countered with the proposal that the benefits of atomic power be foresworn, in order to have closer control of nuclear materials. In the "Franck Report" 1/, transmitted to the Secretary of War in June 1945, the complications of nuclear plenty were anticipated with the suggestion:

> ". . . each nation could be allotted only an amount /of uranium ore/ which would make large-scale separation of fissionable isotopes impossible. Such a limitation would have the drawback of making impossible also the development of nuclear power for peacetime purposes . . ."

This extreme suggestion, running counter as it does to the ever-growing world hunger for new sources of industrial power, was soon overtaken by events. The looming power deficiency has put the world on the threshold of nuclear power. As stated in the report of the President's Materials Policy Commission in 1952:

> "Although conventional energy resources appear adequate to meet the expanding energy demands of the United States at least to 1975 and beyond, the time will eventually come when the fossil fuels will no longer be adequate to do the job. Long before then, the Nation should begin its transition toward unconventional sources, notably solar and atomic energy." 2/

In January 1957, Louis Armand and the other atomic advisors to the nations involved in the EURATOM plan for pooled development stated that Europe's impending power shortages were so great that, with few exceptions, only nuclear power stations should be built on the continent in the future. 3/ Realization of this ultimate need, more compelling in currently power-hungry countries than in the United States, would seem to lead to the inexorable extension of the global possession of atomic materials.

There have been those who have viewed with alarm the incipient diffusion of nuclear materials. Typical of these forecasters of potential disaster is David Teeple, former special assistant to the Chairman of the Atomic Energy Commission, who warned in 1955 after he left the Agency:

> "Once we sent scrap iron to Japan and later it rained from the skies at Pearl Harbor. The risks to the United States in the present program /of distributing fissionable materials to other countries/ do not justify the possible benefits. . . Atoms for Peace can become Atoms for War. This, therefore, is truly America's most dangerous experiment." 4/

In spite of there being grounds for this concern, as will be seen later in the discussion of controls, global possession of atomic weapon capability seems inevitable, even if not fostered deliberately by Atoms for Peace programs. Basic to this is the fact that nuclear weapons "secrets" originally monopolized by the United States and Great Britain, and rapidly acquired by the Soviet Union, continue to spread around the world. All history has shown that one cannot quarantine science. As Mr. Lewis Strauss reminded the United Nations last September, the atom itself is international. His remarks at that time emphasize this relevant and sometimes forgotten fact, and are worth quoting at length because they illustrate why the concept of the "secret of the atomic bomb" was never valid:

> " . . . /the atom/ has no politics and follows no party line. It recognizes no geographical frontiers or allegiances, and the language it speaks is universal. The little group that witnessed the first controlled chain reaction in Chicago in December 1942 included men native to many lands. Their leader was the great Enrico Fermi, by birth a son of Italy. Among his colleagues were scientists from Canada, Hungary and Germany. And contributing to that moment of triumph were the genius and the accumulated discoveries of other men and women from many other lands. Such names as Einstein, Hahn, Strassman, and Meitner of Germany, Bohr of Denmark, Rutherford and Chadwick of England, the Curies of Poland and France, Mendeleev of Russia, and Rman of India, to name only a few . . ." 5/

Manifestly, the knowledge spawned in so many places has not stood still in the fourteen years since the first chain reaction and as became even more evident at the Geneva Atomic Energy Conference in 1956, 6/ the Big Three have no basis for assuming they can husband atomic lore solely for the use of themselves and a few of their respective friends.

Impetus to the spread of nuclear competence has come also from other forces. In addition to the endeavor of nations with power shortages to catch up with the more advanced nations, there is the drive from the advanced nations themselves, and most particularly the United Kingdom, to export nuclear capability as a highly marketable commodity. The United Kingdom, which has pushed atomic power development vigorously to overcome her own power shortages, feels that commercial leadership in the field represents a promising means for bettering her world trade position through the sale of reactors and similar atomic wares.

The major impetus to the proliferation of nuclear reactors has come from the United States, however, whose interest is not so much the immediate acquisition of power for herself or the expectation of commercial profit from the sale of nuclear hardware as it is the hope of fostering technological development in other nations, as a bulwark against Communism. President Eisenhower's proposal of 8 December 1953 to the United Nations that contributions of fissionable material be made to an International Atomic Energy Agency touched off a series of events leading to accelerated application of atomic energy throughout the world.

International discussions were immediately undertaken which led to United Nations endorsement a year later of a proposal for an International Atomic Energy Agency. The charter for this Agency was approved in October 1956, by the United Nations delegates of eighty-two nations and is now before the governments of these nations for ratification.

Meanwhile, scientists and engineers of seventy-three nations exchanged startlingly detailed atomic information at the great 1955 conference at Geneva. The process of pooling knowledge of the atom continued through subsequent international conferences, while the United States entered into almost forty bilateral agreements 8/ with other nations, which entailed not only the gift of complete nuclear libraries and the training of atomic engineers, but also the loan of small amounts of fissionable material for use in research and radioactive isotope production.

As these centrifugal forces developed for the spreading out of nuclear competence, there came growing concern with the fact that the control of the use of nuclear fuels to generate power is difficult; that the existence of full-scale industrial power piles requires large-scale mining of uranium, and large-scale separation of U-235 and production of plutonium; and that these operations are attended by danger of illegal diversion of bomb material to small, easily concealed bomb fabrication plants. The over-all problem which has been voiced by many people in many ways could be summed up by saying simply that, if successful, the Atoms-for-Peace programs will result in a number of countries having competence in atomic energy technology at an earlier date than if such a program did not exist, and that in such countries there will be the unpleasant prospect of the eventual production of very large quantities of fissionable material equally useful for peaceful or military purposes.

Notwithstanding this latent threat to world security, it is evident that the U. S. is committed completely to Atoms-for-Peace. This was reaffirmed by President Eisenhower again on November 15, 1956, when he said "this nation attaches highest importance to the development of nuclear power here and abroad". 9/ The U. S. policy apparently encompasses the hope that safeguards can be established to prevent dangerous material diversion to weapon purposes. Before proceeding to an assessment of the ultimate worth of measures in the IAEA charter for justifying this hope, we might recall that efforts to assert international restraints on the use of these weapons began at the outset of the atomic age. Within a matter of months after the bombs were dropped on Japan, a Commission was set up in the United Nations to study the whole question of the international control of atomic energy and to see whether a system acceptable to all countries concerned could be devised which, according to its charter, would "ensure the use of atomic energy for peaceful purposes only." It is interesting to note that ten years later, after no discernible progress in the field, a paraphrase of these quoted words appears in the statute of the International Atomic Energy Agency, which says that the Agency "Shall ensure . . . that assistance provided by it . . . is not used in such a way as to further any military purpose."

After a decade of more or less futile negotiation, a new proposal emerges for pulling the teeth of the atom. To see whether the Agency gives promise of succeeding where earlier efforts have failed, let us scrutinize its charter.

IAEA Safeguards

The Agency came into being because the big powers in atomic energy wanted to see nuclear power spread under the protective guidance of international control, and because the countries which have not yet developed an atomic energy industry were eager to have guidance and aid. Although all nations have acknowledged the need for controls, there is a significant divergence in the motivation between the "have" nations and the "have-nots". The former feel that establishing the safeguards is paramount; the latter that getting the material and know-how is most important. This difference in emphasis can be illustrated by the reluctance of a significant bloc of nations to submit to the requirement of turning back to the International Agency the fuel elements in which plutonium has been created by operation of the reactor. The demurring nations asserted with firmness their claim to sovereignty over the products of their own nuclear power plants. India's delegate to the United Nations atomic energy conferences typified this nationalistic attitude when he said "We consider it to be the inalienable right of States to produce and hold the fissionable material required for their peaceful power programs." 10/

Although the differences were eventually reconciled, and unanimous approval of the charter was obtained, the basic divergence in viewpoint and the emphasis of the recipient nations on sovereignty provides a fundamental weakness from which diversion can occur.

The system of controls as set forth in Article XII of the charter is based on inspection. Experts in earlier U. N. atomic disarmament negotiations pointed out that the control of any chemical process involves certification of a material balance and that this can be accomplished only by an inspecting staff comparable in skill and size to the plant staff devoted to the same task. The following extract from the report of the Scientific and Technical Committee of the United Nations Atomic Energy Commission illustrates the demanding and almost insurmountable task confronting these inspectors:

> " . . . This incoming material /fuel for a reactor installation/ must be accounted for very precisely . . . stocks must be inventoried meticulously at intervals frequent enough to detect any theft or diversion . . . it will be necessary to machine the material to produce 'slugs' of exact size and shape . . . metal shavings, dust, and

> floor sweepings must be accounted for strictly . . . the slugs must be inserted in protective metal coverings. Here we must guard against the insertion of slugs in overweight containers . . . Extreme care will be necessary to see that all slugs are put in and kept in the reactor and not substituted for . . . /after radiation/ the radioactive slugs are transported to the chemical separation plant. . . all deliveries must be accounted for strictly. . . Now we are entering the most difficult stage. . . all operations must be carried on under heavy shielding by remote control . . . these operations are dissolving, precipitating, washing, centrifuging, and oxidizing. The percentage of the end product, plutonium . . . is so small that it is almost impossible to account for it accurately . . . the losses in the various stages of the process are somewhat variable. Within the range of these losses, it would be possible to conceal diversions of undesirable magnitude. . ." 11/

A corollary of the exacting task of the inspectors is the difficulty of recruiting personnel of the requisite high caliber for so uninspiring and grueling a job. Well qualified scientists recoil from the onerous task of inspecting and policing their fellows rather than working creatively with them. Effective around-the-clock atomic control will eventually entail the direct watching of thousands of reactors, power plants, separation plants, and factories by tens of thousands of technically and liguistically qualified scientists. The commitment of such a corps of inspectors would call for a large percentage of the world's scientists and technicians. They would probably not be available in necessary numbers as volunteers, and the loyalty and reliability of drafted inspectors would probably not be very high. In any case a nation bent on subterfuge would possess enough resources and wits to outsmart the honest inspectors and to bribe the dishonest ones.

If an inspection system were to become effective, the claim of sovereignty could be used to circumvent it. For instance, inspectors could be declared unacceptable on a pretext of misbehavior and accordingly ejected during a long enough period for fissionable material to be siphoned off.

The machinery of the Agency, having been arrived at after

protracted negotiations among eighty nations, is necessarily elaborate. At the pinnacle of its organization is a Board of Governors. The inspectors report any non-compliance they may discover to the Director General, who transmits the report to the Board. Upon receiving it, the Board meets and calls upon the state in question to take corrective action and gives it a "reasonable time" to do so. In the time that would elapse, a dangerous flow of diverted material could be continuing, irrespective of the ultimate action taken by the Board.

A system that is not airtight will not fulfill its purpose in a situation in which national aspirations are at stake. The situation being dealt with is quite different from that existing in the diversion of diamonds from a mine or the evasion of a regulation on alcohol manufacture, in which an individual or a small group of people attempts to hoodwink government systems of inspections and checking. In the field of atomic energy, the type of diversion to be feared is that instigated and implemented by a national government, with all the resources, facilities, and skills which a government could bring to bear on such a project. Consequently, a control organization must be prepared to cope with extraordinarily clever, bizarre, complex and intricate schemes. For example, a nation bent on circumventing a system of inspection of control could well incorporate elaborate provisions to facilitate diversion in the initial construction of its installations, in spite of the Agency's authority to "examine the design" of specialized facilities.

Mr. Bhabha, chairman of India's Tata Institute of Fundamental Research, the Indian equivalent of the A.E.C., described the overall portent in the IAEC deliberations in the Fall of 1956:

> "Let us be clear that no system of inspection and safeguards--not even the system contained in the present draft statute--can ensure, in a world in which the peaceful uses of atomic energy are widespread, that a nation cannot smuggle away enough fissionable material to make a few atomic bombs. It would be completely unrealistic and unscientific to think that the proposed system of safeguards can accomplish any such thing . . . We have, on the contrary, to face the problem that, whatever system of safeguards is adopted, countries will always be in a position to evade them and produce atomic weapons in small numbers if they so wish." 12/

Another factor contributing to eventual loosening of control should be noted. The safeguards of the Agency, spongy as they may be, have the merit of being government-sponsored. There is an inevitable trend as nuclear power gets on a really big commercial basis for private interests to take over ownership, possession, and control of nuclear materials. This logical progression may be construed from the recommendations of the "McKinney Panel", a group of distinguished citizens chosen by the Joint Congressional Committee on Atomic Energy to survey the whole field of the peaceful uses of atomic energy. The panel recommended in its elaborate and far-reaching report that the Congress "create statutory devices to insure continuing review of the present policy of Federal ownership of special nuclear materials in anticipation of the establishment of private ownership." 13/ The pressure for private ownership indicated in this report is only an extension of the sweeping revisions embodied in the Atomic Energy Act of 1954 wherein a government monopoly was replaced by a structure for regulation of private activities. A further increase of private ownership of fissionable materials seems inevitable as capital investment of private industry in nuclear power development grows. Industry will insist on protecting its extensive investment in reactors by controlling the flow of fuel to them. Such broad ownership can only mean progressively less rigorous control and more chance of diversion.

Loopholes

To round out the picture of how fissionable material might get away from accountability and control, some other possibilities will be touched upon.

There is first the major loophole that, even by statute, all circulation of fissionable materials will not fall within the control mechanism of the IAEA. Ambassador Wadsworth recognized this when he said:

> "The existence of the agency and its safeguards would be no barrier to countries which already have the materials and the know-how for making atomic weapons, or can get them from a source which does not insist upon safeguards." 14/

Mr. Bhabha of India used somewhat more colorful language to express the same thought when he said:

> "The elaborate safeguard provisions of the present draft are intended to ensure . . . that not the slightest leakage takes place from the walls of a tank, while ignoring the fact that the tank has no bottom." 15/

The United States took cognizance of this factor by trying to do something about the fact that the U.S.S.R., like the U.S., has been engaged in bilateral atomic transactions with a number of states. Since 1954, the U.S. has negotiated with the U.S.S.R. for safeguards on the Soviet distribution commensurate with those of the U.S., before the horse was out of the barn. U.S. concern in this matter is summarized in its aide-memoire to the Soviet Union of August 15, 1956:

> "The Government of the United States is also interested, therefore, in exploring the possibilities of reaching agreement to standardize the safeguarding terms on which countries would supply on a bilateral basis atomic energy assistance in the peaceful uses field. In this connection, it is recalled that the Soviet Government in the Memorandum of July 18, 1955, stated that the Soviet Union had already initiated a program for rendering such assistance to a number of states and that it intended to broaden this circle of states." 16/

The discussion with the Soviets have taken the various twists customary for East-West negotiations, and though the Soviets profess to recognize the threat, no agreement has been reached in achieving a common standard of safeguards for the respective bilateral agreements. This deficiency represents a loophole in control, irrespective of the effectiveness of operation of the Agency.

On top of this there is the fact that any nation which has the brains and resources can embark upon nuclear production without entering any agreement, bilateral, multilateral or otherwise. France, for instance, has reached the position, without direct help from anyone, where if she makes the decision to do so she can make weapons within a very few years.

When there are hundreds of power reactors in dozens of countries, another potential problem arises. The possibility of seizure by force of these stocks of fuel elements containing plutonium becomes a threat. Seizure of fissionable material is obviously not an

easy undertaking, particularly if the material is still in a highly radioactive state. Yet the stakes are high, and highjacking of the material, particularly while it is in transit, is another means by which weapons material can get loose in the world.

Production

Given the several possible roads to diversion of fissionable materials just described, it is necessary to take a hard look at what kind of job it will be for a small nation to make atomic weapons.

Of the two avenues theoretically open for obtaining weapons grade material--separating uranium-235 from uranium-238 by an Oak Ridge type of process, or creating plutonium or uranium-233 in a reactor-the latter would seem to be by far the more feasible for a country with limited industrial capacity. The size and power consumption of uranium isotope separation plants are such that it would be extremely difficult to operate one clandestinely, and even overt construction and operation of one would be almost beyond the capability of any but a major nation. In case an isotope separation process were practicable for a nation, access to the enriched uranium currently sold by the United States would be most helpful. When natural uranium has been brought from .7 of one per cent to an enrichment of 20 per cent U-235, most of the work is done.

The reactor approach seems the most probable one because of the fundamental fact that the natural process for making weapon material and turning out useful power is essentially the same. Even by this means, weapon material will not be growing on trees. Costs for a reactor that will produce meaningful quantities are high; the first four power reactors being constructed in the United States have an average cost of about 35 million dollars. (Reactors with less output could of course be built with less money and these would turn out the same kind of fissionable material, although at a slower rate.) To reactor cost must be added the expense of the chemical separation facilities and a weapons fabrication plant. However, the fissionable material and the reactor moderator being sold by the United States is fairly reasonable in price, thanks to U. S. mass production; U-235 of 20 per cent enrichment is $16 per gram of U-235 content and heavy water is $28 per pound. 17/

Recovering plutonium from a reactor by chemical process is a complicated job. One does not simply open a door and take it out, box it and ship it. Even though the production of fissionable material is no longer basically a problem for science, it remains an engineering

problem of some complexity and dimension.

For a nation really to move into the nuclear weapons business it would have to be able to accomplish all four of the various manufacturing processes necessary to produce fissionable material. The task would amount to building factories to: (1) extract uranium metal from the ore; (2) irradiate uranium metal in reactors; (3) extract plutonium from the metal, and for the more advanced types of reactors (4) enrich uranium in U-235 content by an appropriate process for use as a fuel. For a nation not intending to produce many weapons, these facilities need not be large, however.

Further, an important fact bearing on possible control measures is that the actual fabrication of the weapon from the fissionable material, once produced, presents a comparatively minor problem. A well-informed team of engineers and physicists could probably manufacture the weapons components in total secrecy with the facilities of a small ordnance works. This puts sharp focus on the fact that if control is weak at the reactor or separation plant, the chances of over-all control are virtually nil.

Timing

Let us now try to gain a feel for how long it will take lesser countries to eventually acquire nuclear weapons, since the rate at which they do so may bear materially on U. S. security plans.

The onset of some degree of threat does not necessarily have to await the widespread and economical utilization of nuclear power. Yet, truly widespread availability of fissionable material will be a function of the number of nuclear piles and the profusion of their products. Accordingly, let us examine the prospective rate of nuclear power development. The evidence in this area is conflicting, and changing rapidly. In June 1952, the President's Materials Policy Commission reported: "It does not appear that nuclear fission can be regarded as a contribution in any substantial degree to electric generation during at least the next 10 to 15 years . . ." 18/

And yet this year prominent Britons have said nuclear power development comes only just in time for the United Kingdom and that by 1975, or in less than 20 years, half its electricity will be developed from nuclear energy. The opening of Calder Hall as the first major nuclear power plant in the world and the planned construction of twenty-two other British nuclear power plants in the next five years attest to the dispatch with which the U.K. is carrying out this forecast.

In most places nuclear power is more expensive than conventional power, but to many countries this is not the important point. What is important is obtaining an additional energy to supplement overstrained conventional energy resources (and at the same time obtaining as a bonus a source of nuclear weapon material). For instance, recent appraisals, sharpened no doubt by the impact of the Suez situation, indicate that a disastrous energy shortage can be avoided in Europe only by a crash program of atomic energy development. The previously mentioned proposal of the consultants to the EURATOM countries that only nuclear power stations be built on the continent in the future, points to the prospective imminence of all-out nuclear development in other areas. One has only to look back upon the very recent past to realize how dangerous it is to predict the rate of progress on this subject. It has been less than fifteen years since Enrico Fermi and his team of pioneers first harnessed the power of fission in a primitive reactor in Chicago, and but ten years since a group of specialists first began serious studies of a "power pile" at Oak Ridge. Since the day in December 1942, when Fermi's pile went critical, producing only a few watts of heat, the United States has built and operated some eighty reactors of various types and sizes, and American industry has now plans to install some 700,000 kilowatts of nuclear power.

What has taken place within the space of fourteen years gives indication of the shape of things to come. Available evidence indicates the danger of diversion of fissionable materials will begin in some countries in about 1960, and will grow into a significant threat in many parts of the world by 1970. A later section suggests a sequence in which specific countries might acquire a capability to produce weapons.

Gifts

We consider next the most readily available means of acquisition--outright gift or loan by the "have" nations. Weapons as gifts can be of course passed to smaller nations at any time and be immediately available for employment, subject to the limitations touched upon later. There are, however, many factors of restraint in such a transfer, as is illustrated by the restrictions on the transfer to other countries contained in the U. S. Atomic Energy Act. In time, such arming will probably take place, within NATO and within other alliances, both Communist and Free World. Even today such a move could already be underway within the Soviet orbit, as for instance, from the U.S.S.R. to China. If atomic weapons are looked at as differing only in degree from other armaments, then nuclear arming of an ally follows logically on the heels of other arming, and a compelling case could be

made for the purely military utility of providing nuclear weapons for use in an operation such as the invasion of Taiwan, for instance. However, the initial decision to use even a single atomic weapon, after a decade of emotionally-laden talk about the moral, humanitarian, and genetic ramifications of nuclear warfare, would not appear to be a matter that the Soviets would elect to leave to a junior partner. Furthermore, the triggering of an atomic exchange at the semi-strategic non-all-out level, would seem to offer too perfect an opening for the U. S. to respond in kind, in a field in which, in spite of bilateral atomic plenty, the U.S. still has the quantitative advantage.

In addition to the danger of the premature setting off of nuclear war, there are two other potential debit factors in passing over weapons to an ally. One is that the weapons, held by a junior ally, may be less secure than when under the wing of the originating country. This security shortcoming has two aspects--the possible leakage of specialized technical know-how about the weapons, through less adequate information control standards, and actual physical loss of the weapons through capture by hostile forces. The former leakage would be minimized if obsolescent or the less sophisticated weapons were furnished.

Again, a donor nation might have misgivings because of the possibility of the weapons being turned against her by the recipient nation. The ways of power politics are such that such a twist is not outside the realm of possibility. Consider, for instance, Yugoslavia. Would either the U.S. or the U.S.S.R. feel secure in giving nuclear weapons to Tito?

This aspect of mutual trust brings up the interesting contemplation of what might be done to undermine the confidence a nation has for one of its allies by the transfer or threatened transfer of a small number of weapons to the ally by an enemy. For instance, if a dozen old style weapons were given to Communist China by the United States, would this increase or decrease the over-all strength and solidarity of the Communist Bloc? Such concepts are dream stuff, of course, but given certain conditions in a rapidly changing atomic world, is such a move outside the realm of possibility? In the example under conjecture, dissidence within China toward the U.S.S.R. would need to be a prerequisite, as would the provision of counterbalancing nuclear weapons to our own Asiatic allies. With these conditions satisfied, a potential for such a move could conceivably exist. If a few plane loads of submachine guns dropped to resistance elements in World War II helped to set the stage for success, the issue of nuclear weapons to dissident forces might have a potential for extreme internal disruption, especially in an alliance created by force and steeped in suspicion.

Irrespective of the fanciful aspect of this particular hypothesis, it is probable that in a world in which nuclear weapons are commonplace, present international power balances will be materially modified, just as warfare itself was by the advent of the Hiroshima bomb. Assessment of the balances will need to be made imaginatively and continuously in order to exploit nuclear weapon distribution as an instrument of our national security. A particularly fruitful area of exploration would seem to be the provision of a stock of weapons to the United Nations, for further issue to nations subjected to aggression.

These, then, are a few of the factors bearing on acquisition by gift, and hence on the timing of the appearance of nuclear weapons by this means, in the arsenals of the smaller nations. In summary: -- such transfers could take place today and will no doubt take place eventually, probably within the tightly controlled structure of operating military alliances. It is likely that in ten to fifteen years nuclear weapons may be transferred to allies with the freedom, although not the profusion, of M-48 tanks and F-86 fighters today.

Weapon Concealment

The control of weapon possession having been already discussed in connection with armament regulation, it might be well to examine for a moment whether the actual possession and stockpiling of nuclear weapons, acquired either by local manufacture or as gifts from other nations, can be regulated by inspection.

The answer is obvious that atomic weapons once obtained can be successfully hidden, even in the face of thorough inspection. In the hearings on the formation of the Atomic Energy Commission in 1945, Dr. Oppenheimer told the Congress that there are no ingenious devices whereby one nation could detect or control atomic armament of another nation committed to secrecy.

This statement seems, from available evidence, to be still true today. On January 17, 1957, the Deputy Director of the Defense Department's Weapons System Evaluation Group, Dr. Hill, told Congress that he had no knowledge of any way of detecting concealed stockpiles of nuclear weapons. 19/

In connection with weapons storage it is particularly worth noting that fissionable material in a weapon, concealed or otherwise, suffers no deterioration or obsolescence. A cache of "insurance weapons" can be put away by a nation and brought out any number of years later, remodeled as necessary, and either used for surprise attack or diverted to peaceful purposes.

Chapter II
THE POTENTIAL POSSESSORS 20/

Last year, Harrison S. Brown, professor of geochemistry at the California Institute of Technology, said at a Brookings Institution lecture:

> "Today there are government-sponsored groups working on atomic energy in many of the nations of the world, ranging from the nations of Western Europe to many of the nations of Asia, including India, Pakistan, the Philippines and Japan. Soon we shall observe the production of electricity from atomic energy in many of these areas, and not long after that time, we may well observe the production of stockpiles of atomic weapons. The effects of these developments on the relations between nations will certainly be of enormous scope." 21/

Accepting with Professor Brown the premise that effective control of power production is improbable, we might try to put a sharper focus on his more or less generalized remarks which are typical of many which are heard. Let us try to get a somewhat more specific idea of what is meant by such phrases as "many nations" and "soon". This is not easy, in view of the various imponderables bearing on a nation's atomic progress, but perhaps an order-of-magnitude feel for the subject can be gained.

Illustrations

As a first step, a few thumbnail illustrations might be given of the atomic activities in typical well-advanced countries:

Canada took part in the U.S. and U.K. developments from the very earliest days and is one of five countries with major installations at present. The fact that her first reactor upon its completion in 1947 turned out to have a higher neutron flux than any existing reactor typifies the remarkable success of the Canadian program. Using her extensive uranium deposits, Canada is moving vigorously into atomic power development.

France, who launched her atomic energy program in 1945, stands closest to the Big Three and Canada in progress. After completing two research reactors in 1952, she embarked on a large-scale program for power development. Using fissile fuels from her own sources, she

is constructing a plant of three reactors which will produce 100 kilograms of plutonium annually when completed. The first reactor, already operating, provides 40 megawatts of power. A $15,000,000 plutonium separating plant and several commercial power reactors are being constructed.

India has an efficient, highly respected atomic energy establishment. Her Tata Institute, under the aforementioned Dr. Homi Bhabha, the distinguished Indian scientist who presided at the Geneva Conference on Atomic Energy in 1955, has a well advanced nuclear program. A uranium processing factory has been built and two reactors are under construction. India has one of the best-known deposits in the world of monazite, a sand containing thorium, and it is expected therefore that one of India's major interests in the future will be reactors which can breed new fuel from thorium.

The Netherlands formed jointly with Norway a nuclear research center where a 100 kilowatt reactor was completed in 1951. To compensate for limited supplies of fossil fuel, Holland is working toward a 100 megawatt reactor to be completed in 5 to 8 years.

Sweden, having been since 1945 engaged in fundamental atomic research, has a cyclotron, betatron, and a 200 million electron volt synchrocyclotron. Her first nuclear reactor, housed in rock caverns under Stockholm, will be followed by a second reactor in the power range of 10-20 megawatts. Sweden appropriated on the order of $85 million in 1955 for an atomic weapons program.

In Switzerland, eleven Western European countries 22/ have banded together to locate, near Geneva, a central European nuclear research laboratory, with a particle accelerator more powerful than any in the U.S. Switzerland herself plans a 10 megawatt natural uranium reactor.

Brazil has some of the richest deposits of thorium in the world. Spending as she does almost 80 per cent of her dollar income on imported fuel, she is the most aggressive country in South America in going after nuclear sources of power.

Japan, a late entry into atomics, hopes to build its own reactor in 1961, after first buying four small ones from the U.S. A nation ill-endowed with natural resources, Japan expects to halve the cost of electricity by 1970 through atomic power.

Belgium, with a strong scientific and technical community, is

financing her ambitious program with returns from the sale of Belgian Congo uranium. Her bilateral treaty with the U.S., signed in 1955, goes farther than those signed with most other countries. A 3 megawatt reactor is under construction with fuel elements from the U.S., while a full-scale 10 megawatt electric nuclear power plant is in the planning stage.

West Germany, by the treaties granting her sovereignty, is under restrictions with respect to her holdings of fissionable materials. Nonetheless, she is motivated by both her power shortage and her hopes of eventually developing an atomic export business to try to quickly narrow the wide atomic gap between herself and the Big Three. After purchasing two experimental reactors from the U.S., Germany intends to build reactors using her own Black Forest uranium.

This brief view of atomic progress in smaller countries is only illustrative and not all-inclusive. Furthermore, atomic progress among smaller countries is obviously not confined to those of the Free World such as are named above. Comparable progress can be assumed to be taking place also in certain of the Communist satellites, subject, of course, to rigid Soviet control. The hard evidence on what is going on within the Soviet bloc in atomic matters is no better than that on other subjects except when a Communist atomic explosion occurs. However, it would seem safe to assume that satellites as industrially advanced as East Germany, Czechoslovakia, and China, are busily engaged in nuclear activity. At Geneva, the Soviets described a 6.5 megawatt heavy water research reactor intended for installation in Communist China. The Czechoslovakian representative to the IAEA Conference in 1956 told the delegates that, with the help of the Soviet Union, his country would have a 150 megawatt atomic power station by 1960 and plants for the production of fuel elements by 1965. Similar Soviet support to other satellites, as well as to uncommitted nations, can be expected eventually.

A Time Frame

Now to recapitulate and at the same time proceed a step farther by suggesting a rough breakdown of the nations of the world into the time frame in which they might be expected to be able to make their own atomic weapons.

In general, a country's ability to produce fissionable material and nuclear weapons is a function of its supply of uranium, its industrial capacity, its economic condition, and the capability of its scientific personnel. These circumstances, along with the need

which a country has for new power sources, and its evident interest and effort in atomic matters, can be assessed to provide a general concept of a country's atomic status. The listing which follows is drawn from a rough synthesis of these various factors. In the case of the smaller countries, inclusion on the list conveys the capability to fabricate initially from fissionable material available to the country a crude, comparatively low yield weapon. We start with the three nations now known to be possessors:

United States United Kingdom U.S.S.R.

Next we have two nations which, as we have seen, are far enough advanced in nuclear matters so that they can be considered on the threshold of being able to make their own weapons. We will say their prospects are for acquisition within the next five years or

Near Term: Before 1962

France Canada

Then there is a group of nations likely to gain a capability in the next five-year period, which we call the

Intermediate Term: 1962-1966

Argentina	Denmark	The Netherlands
Australia	Eastern Germany	Norway
Belgium	Italy	Sweden
Communist China	India	Switzerland
Czechoslovakia	Japan	Western Germany

A sizeable number of nations fall into the next category--one in which we presume the ability to produce atomic weapons sometime after 1966 if the nation's over-all industrial capacity increases at its present rate or better and if appropriate preparatory efforts are begun soon. This period a decade from now we will designate the

Long Term: After 1966

Austria	Mexico	Spain
Brazil	New Zealand	Union of South Africa
Ireland	Poland	Yugoslavia
Israel		

Within this category are a number which are possible but doubtful:

Long Term: Possible

? Bulgaria	? Egypt	? Peru
? Chile	? Hungary	? Philippines
? Colombia	? Pakistan	? Rumania

Then in still another category are the rest of the nations of the world, which will probably not be able to make their own atomic weapons at any foreseeable time. A number of these countries will at some time, however, be able to obtain weapons as gifts or by stealth. Without running off an exhaustive list, a few of these have-not countries will be named, in order to bring them to mind:

Burma	Guatemala	Korea	Syria
Cuba	Honduras	Laos	Thailand
Ethiopia	Jordan	Liberia	Tibet
Haiti	Iraq	Paraguay	Viet Nam
Cambodia	Iran	Panama	Yemen

Now it is obvious that an effort, such as the one preceding, to pierce the fog of the future must contain gross errors, but if one were to assume for a moment that these errors are within narrow margins one could recapitulate as follows, each statement of numbers being cumulative:

5 countries able to make atomic weapons within 5 years;
20 countries able to make atomic weapons within 10 years, and
30 or more countries able to make atomic weapons eventually.

Suppose then we substitute an assumption of a 50 per cent error in over-estimation and cut all the above figures by one half.

We wind up with a forecast of atomic weapons emanating from a minimum of 10 different nations within 10 years and from perhaps 15 or more nations in the foreseeable future.

This estimate is offered as a crude gauge of the imminence and degree of the threat discussed in this paper of lesser nations making their own weapons. To this picture must be added the much broader potentiality discussed earlier of the acquisition by almost any nation of atomic weapons by gift.

Chapter III
THE CONDITIONS FOR USE

Concluding from the preceding chapters that possession of nuclear weapons will in due time become commonplace in many lesser nations, we pass to consideration of the conditions and terms governing their use. In many respects a smaller power cannot exercise the freedom of the Big Three in employing or even talking about employing its comparatively limited supply of weapons. Subterfuge in possession and employment will be not unusual. Conceivable opportunities for use will be less, and employment will presumably most often be a function of desperation and opportunism.

A Meaningful Stockpile

From the preceding survey it is apparent that few countries will have atomic weapons in profusion. Quantities will necessarily be less by many orders of magnitude than the holdings of the Big Three. This raises the question whether "fourth countries" will acquire them in numbers that will be significant in a power sense--whether they will ever have enough to make it worth-while for them to enter a fight. Part of the answer is that a smaller country would not need the number which the U.S. and U.S.S.R. need to cope with each other in a war. Under the conditions of use to which smaller countries will be bound, the utilization or threatened utilization will be on a much more modest scale, in terms of absolute quantities. Yet the results may be decisive at a very low level of employment. Being hit by a single bomb could virtually spell curtains for many nations: Egypt - Cairo; Albania - Tirana; Iraq - Baghdad, to suggest a few. Other larger countries have their heart in one city to an extent that a single bomb could constitute an almost unbearable threat even if used only for blackmail. Consider, for instance, the reaction of the French to a tangible and proximate threat of the destruction of Paris.

In greater numbers, say several dozen, a nation would have a greatly enhanced capacity for doing mischief. It could not only threaten, as a desperate stroke of blackmail, the annihilation of a larger nation's vitals, but it could carry out this threat and still have some weapons with which to make retaliation costly.

For tactical employment, the requirements for quantity would rise, although against an enemy not also nuclearly armed the numbers would still be quite small. For certain tactical purposes, as for instance the radiological contamination of critical geography, such as

the Suez Canal, again one or two weapons might have great significance.

Means of Delivery

A smaller country cannot, any more than a larger country, actually damage an enemy merely by having nuclear weapons stockpiled. Getting the weapons to a place where they can be profitably detonated is essential.

An atomic weapon can be delivered most readily by aircraft by a country of any size. In the case of the smaller country, not having a force of large bombers, such airborne delivery may more often be done surreptitiously, by means of clandestine or commercial aircraft. However, as weapon size diminishes with time, the possibility is increased of successful air delivery by fighter planes by countries not possessing bomber aircraft.

The next most likely means of delivery would seem to be by ship, since the carrier can remain under control of the delivering nation until the instant of delivery. One cannot discount the ability of a lesser nation to attack by guided missile from shipboard or submarine, if the sophistication of the nation's armament is such that weapons of the complexity of missiles are available. However, even for the most retarded countries, clandestine ship-borne delivery is a capability to be reckoned with by any country having seaports. By the techniques of mining, a weapon can be surreptitiously dropped in a harbor, set to detonate at any future time. The United States has an extensive program for guarding its ports, a major purpose of which is protecting against this very threat.

Nuclear weapons can be conveniently transported by railroad car, truck and automobile, in so far as their size is concerned; however, the risk of detection at customs points make the hazard of this method greater, and less likely to be used, at least at border crossings. Progress in the miniaturization of nuclear weapons presents an ever-increasing possibility of transport by hand, either assembled or disassembled, but again, there is a risk of customs detection except with an unusual means of entry such as a parachute drop or secret beach landing.

The means most free from detection would seem to be shipment under diplomatic immunity. There appears to be no reason why a disassembled weapon cannot be introduced into the capital of any country, in the inspection-free pouch of a diplomatic courier, with

virtually no chance of detection.

This brief listing of possible means of delivery underlines the problem, from the smaller country's point of view of delivery both in militarily significant quantity and in a detection-free manner. The latter consideration is paramount in any case of clandestine delivery, since it is manifest that there is no margin for error. Detection, and consequent identification with the introducing country, could lead to divulgement of the over-all strategic intentions of the country concerned, and to national annihilation.

It seems probable that except for overt employment against a neighbor of equivalent or lesser power, a country would be inclined to use these weapons under the cover of other events, in which larger countries are involved, so as to gain some measure of protective coloration. In this connection, it is obvious that use is also governed by the over-all status of the nation's armed force. Just as nuclear weapons cannot become effective without appropriate delivery means, so can they not be employed significantly without adequate back-up from other weapons systems. In most circumstances, for instance, it would be fruitless for a nation to devastate a couple of its neighbor's cities, if that neighbor could move freely against it in retaliation and occupy it by conventional forces without resistance.

In any case, a smaller country, like a larger, can afford to use nuclear weapons only if it is fully prepared to take the consequences of detection of its actions. This assumes progress within the country in defense measures, civil and otherwise, concommitant with weapon development, and these measures in themselves may give clues of the country's hostile intent.

Testing

The factor of confidence in one's weapons bears importantly on nuclear weapon stockpiling and utilization. Ambitious test programs in all countries presently possessing such weapons testify to this.

In small countries lacking in nuclear experience, the need for such reassurance would presumably be high. A nation producing a weapon from scratch would certainly want to proof-test it to satisfy itself that the produce derived from its new-found nuclear technology could in fact be relied on as an element of power upon which national survival would be gambled. A nation receiving weapons as gifts would most reasonably wish to look the gift horse right in the mouth, and test one or more weapons, randomly selected, to make sure of good faith.

There is a chance, of course, that a nation would be willing to forego the reassurance of making certain that its weapon would detonate as expected. The United States did drop a type of bomb over Hiroshima which it had not previously exploded. However, the earlier successful test in New Mexico of a more complex design had made the United States confident of the competence of its atomic scientists.

Nuclear testing can often be detected by a nation organized to detect such happenings. However, testing is not necessarily detectable. If the detonation is small or if it is in an out-of-the-way place such as a deep mine or a remote area of the oceans, there is a good chance that it would not be discovered, or if it were, that it could not be attributed to a specific nation. Nonetheless, the possibility of having a test revealed would tend to restrain a nation from laying its plans on the basis of having secret possession. This, coupled with the preponderant probability that a nation will feel constrained to "prove out" any weapon it acquires, places additional restraint on the surprise factor requisite for many of the means of delivery outlined above.

Employment

The variety of ways in which the war may come cannot be easily catalogued or forecast. However, it would seem that over and beyond the conditions attendant to any war, regardless of type, certain situations would be more likely than others to obtain when nuclear weapons are employed by the lesser nations.

One of these situations and one most potentially disruptive to world stability is the possibility that the possession of some atomic weapons will instill in a country's ruler a spirit of conquest. Harvard sociologist Pitirim Sorokin has said that it is quite foolish to expect that unscrupulous or shortsighted heads of government would willingly abstain from the use of such weapons. 23/ It is, of course, not as simple as this. Many restraints will be present to temper an attitude of aggression.

A case from recent events illustrates the way the spread of nuclear weapons might actually support the aspirations of smaller nations. Two ostensible reasons that Nasser vigorously went about arming Egypt were (a) to discourage Israel from undertaking territorial aggrandizement through military means, and (b) to attain a position of power dominance within the Arab world. Both of these purposes would have been admirably served by the possession of nuclear weapons. If Israel, or her allies, had not had the capacity or inclination to demonstrate commensurate power, Egypt's dominance would have gone

unchallenged. Her capacity for international blackmail, already amply manifested, would obviously have been enhanced, and her military capabilities in campaigns against an opponent who lacked atomic capabilities would be dramatic. Manifestly, the drive for any rival of Egypt's, e.g. Israel, to obtain balancing weapons, would become intense. We would see a case wherein the atomic stalemate between two major world powers would be made more complex by an all-out atomic arms race between minor powers. A case of mutual deterrence at the second-team level might develop. Taking a look at the Egyptian episode from another viewpoint, it is interesting to reflect on the impact that Egypt's possession of a few nuclear weapons would have had on the deployment and utilization of the British fleet in the close confines of the Mediterranean.

A more benign employment, if use of nuclear weapons can be so characterized, is the utilization by a nation that is really defensively minded. Certainly the capacity that a neutral nation, such as Switzerland, would have for retaliation against an aggressor would be greatly enhanced by a pocketful of nuclear weapons. There would of course, be here, as in other situations, a strong element of mutual deterrence, and Switzerland, in employing nuclear weapons to counter an invasion threat by a larger power could reasonably expect the destruction of Berne, Geneva, et al. On the other hand, the invading nation not only would be confronted with the chance of being repelled, but also would face the additional unpalatable probability of the liquidation of a number of her crack assault divisions that might be needed for tasks more strategically important.

In net balance it would appear that in spite of the limitations governing employment, any country, aggressor not, would be comforted to have the "ultimate" weapon as a latent threat against its natural enemies, and as has been seen, the day is coming when many countries will be so equipped.

Chapter IV
THE IMPLICATIONS WITH RESPECT TO WAR AND PEACE

In considering the implications of the worldwide spread of nuclear weapons, we could talk of their impact upon nations--how countries acquiring them will be made stronger while strong countries will be made relatively weaker, how countries obtaining them will be faced with problems of military reorganization now plaguing large countries, how nuclear weapons will unsettle the internal politics of small and unstable countries -- but it is not the impact on individual countries

which is the important effect of the worldwide spread of nuclear weapons. What particularly needs examination is the effect upon war and upon peace.

To begin with, it becomes most obvious that with multiple national holdings of nuclear weapons, the nuclear stalemate may not long continue under bi-polar control. The situation since about 1950, wherein the option to embark upon nuclear war rested with two roughly equal adversaries, will not necessarily prevail. It is hard to tell how much will be left of the bi-polar nuclear stand-off when a number of nations have the capability of blowing up some of the industrial and population centers of their neighbors and, for that matter, of the two superpowers themselves, but it is manifest that the major powers alone will not determine whether a war will be atomic or non-atomic.

The atomic stockpiles of the United States and the Soviet Union have been a force for peace, however precarious. Korea notwithstanding, the overall armed forces of the two countries have been held essentially in check by the atomic threat during a decade of great tension, and by oft-mentioned mutual deterrence have prevented major conflict. This thought was expressed by Hans Morgenthau, perhaps somewhat extremely, as follows:

> "It is this technological neutrality of atomic energy, no longer monopolistically controlled by two frightened and hence responsible governments, which opens political vistas, appalling in their revolutionary implications . . . Atomic power haphazardly distributed among a number of nations, is bound to be a source of unprecedented insecurity, if not of panic." 24/

The latent threat is enhanced when such weapons are in the hands of the politically immoral and uninhibited and, more particularly, in the hands of governments or political (and criminal) groups willing to employ such weapons for the blackmail or destruction of their opponents.

We should expect that in the face of a deadly retaliatory threat from the larger powers, the lesser aggressors might abstain from the employment of nuclear weapons; yet this expectation cannot be firm, because the aggressor may be able to neutralize, by military or political means, the capability or willingness of opponents to retaliate. Secondly, the aggressor leader may be a madman and hence not

rationally heedful of the consequences of his acts. (When considering the effect upon the world of madmen with nuclear weapons, we might reflect upon which would have happened if the Nazis had come into the possession of an operational stockpile of atomic weapons.) Thirdly, depopulation and the creation of ruin and chaos may be one of his primary objectives, in order to provide a seed bed for his ideology.

With atomic weapons in the hands of many nations, a special kind of confusion may ensue when and if war actually begins. At present, with essentially only two possessors, it is not hard for one to decide, if attacked suddenly and clandestinely by nuclear weapons, that they came from the other. Appropriate retaliatory counteraction can be taken at once, before other blows fall. Ten years from now, the attack will conceivably have come from any of a number of nations, and immediate attribution to and action against a specific foe may call for an extremely delicate decision. During the course of a war, confusion may be compounded by other anonymous nuclear detonations, undertaken with spite or malice by the adversaries or by bystanders.

A slow trend toward anarchy becomes apparent; we will examine later the forces restraining it.

Another prime implication of widespread holdings of nuclear weapons is, as Secretary Dulles told the Geneva Meeting of the Foreign Ministers, that war itself becomes more probable. 25/ The wide existence of weapons of this magnitude, primed, aimed and ready to fire, is itself an invitation to tragedy. A corollary of this premise is that the involvement of larger powers in a war started by smaller powers also becomes more probable, by virtue of the fact that nuclear weapons are likely to make a war of smaller powers more far-reaching in its effects than it would have been heretofore. Even though the U.S. and the U.S.S.R. pursued a policy of peace, there would be great danger that they would both be drawn into the war before it was over.

On the other side of the coin, if nuclear weapons were widely enough distributed in the Free World, particularly among the NATO allies, the mere knowledge of this widely dispersed deterrent might make war less likely by giving the U.S.S.R. pause in considering aggression. It would not be enough for the Soviets to be able to hit 90 per cent of the Free World atomic bases with total surprise, if the 10 per cent they could not locate and hit might deal them a catastrophic blow. Once the various free nations have acquired quantities of

nuclear explosives, the Communists will have a tougher problem.

Another consideration is whether war will be nuclear or conventional. The war will be fought in the shadow of nuclear power but will the war actually be fought with nuclear weapons? The chances are that the answer to this question is yes, provided that a war which begins with conventional weapons becomes unlimited in its scope. As James E. King puts it:

> "Unlimited, or total, conventional war in an age of nuclear plenty is a contradiction. Not only would the side that mobilized its resources and deployed its forces for total conventional war invite nuclear attack under the circumstances most favorable to the enemy, but also it would be exerting its force to such an extent that its enemy must certainly be driven to nuclear retaliation." 26/

The corollary of this is that in a nuclear age conventional wars tend to be restrained out of fear of their becoming large. As possession spreads, this Korea-effect may become more pronounced.

In a world committed to all-out development of atomic power, once really large-scale war does break out, each nation will then try to get nuclear weapons for herself, even if she did not have them at the outset of the war. Every nation involved will feel compelled to secure the most potent weapons possible. Her atomic power plants will give her the means of doing this, even if in the preceding period of peace nuclear weapons had been eliminated from national arsenals. The premium in such an arms race obviously would go to the most unscrupulous nation--the one who had made the most extensive preparations for thwarting international control or the one who could steal the most at the outset of the fighting.

In a searching article in the Review of Politics, "Ferreus" has this to say about the inevitably widening and all-pervasive nuclear aspect of our age:

> "However distasteful it may be, nuclear weapons of the fission and fusion types have come to stay. Henceforth, they will be as much a part of human existence as rain and snow, morality and crime, the telephone and airplane, pacifism and aggressiveness, freedom and tyranny, stupidity and wisdom. It is unlikely that this new invention can

be undone except through the destruction of civilization itself. On the contrary, nucleonics will sooner or later provide the foundation of industrial civilization all over the globe." 27/

The picture he paints, broad though it is, does not portray the full impact of the ultimate spread of fissionable material. When there is a reactor serving almost every world community, the deadly substance, plutonium, will be coming forth into the world at a prodigious rate. To get the critically essential power, the plutonium must be made; and this substance, a few pounds of which can destroy a city, will eventually be available in every back-woods principality.

The most outstanding implication of this situation--in fact, the only meaningful conclusion from it--is that the world must learn to live in peace or it must perish. In assessing the prospects for peace, let us weigh a few of the pertinent factors to see on which side of the ledger they are.

Considering first the debit side, we recall that the establishment of an international control apparatus to prevent production of nuclear weapons is obstructed by practical difficulties of inspection which might defeat even an international agreement undertaken in truly good faith by all sides. Considering this alone, international control could be regarded not only as an illusion but also as a device which, if solely counted upon for protection, would constitute an extreme and unacceptable security risk.

With respect to disarmament, the broadening of nuclear holdings will be another debit item. Atomic competence in a number of countries will make any ultimate control scheme more difficult of accomplishment, by virtue of the vast extension of the task. If disarmament and control ever became a reality throughout the world, then a smaller country's acquisition of even a few weapons would constitute a major threat to world security. In a supposedly disarmed world, substantial diversions from foreign nuclear power installations could involve a great risk to world stability and peace.

Now, as to the other side of the ledger. What forces deriving from wholesale nuclear weapon distribution make for peace and disarmament?

One crucial force is a possible change that might occur in the outlook of the Soviet Union. An argument linking the outcome of the problem to the ultimate attitude of the Soviet Union might go like this:

worldwide control will not be effective without control in the Soviet Union; control in the Soviet Union will not occur until the Soviets are persuaded that their present courses of action toward world domination are unwise; such persuasion will not come about until the Soviets are made to believe a reality of the nuclear age--that the continued pursuit of the revolutionary goal, in disregard of the dangers of nuclear war and of the unpopularity of the Soviet Government at home and abroad, may spell the doom of the Communist regime (regardless of what happens to the Free World).

Buried within this proposition may lie a germ of the ultimate outcome. Like the United States, the Soviet Union may be assumed to be prey to marked misgivings about the uncontrolled emergence of nuclear weapons in many parts of the world. She cannot be blind to the prospect John von Neumann described when he said, "for the kind of explosiveness that men will be able to contrive by 1980, the globe is dangerously small, its political units dangerously unstable." 28/

She may come to believe that unless she unbends, the course of nuclear events will prove her undoing, and she may actually modify her position to accommodate to this belief. The U.S.S.R., along with the U. S., might come to the conclusion that to avoid nuclear anarchy in the world she must set an example by curtailing her own nuclear weapon production. More specifically, the two powers cannot prohibit other nations from building nuclear weapons if they continue to build weapons themselves. As the sharp necessity grows for de facto arms control, the reality of control may come closer.

The above hypothesis may sound extravagant, and it may prove to be. There are, however, forces in motion that could cause an accommodation of the sort suggested. Extremely significant is the disruptive pressure within the Soviet Bloc manifested by episodes like the Hungarian revolution. Added to this force upon Soviet decision-making is the unifying and coalescing force arising from the global nuclear revolution. This acts upon large segments of the Free World in the form of four related motivations:

- # The drive to collaborate on the production of atomic energy for peaceful uses, e.g., EURATOM.
- # The need to share expensive separation facilities.
- # The requirement for unified global control of nuclear activities.

The drive for collective defense in the face of future widespread holdings of these lethal weapons.

From these motivations something important may happen in international relations. International atomic energy control involves voluntary cooperation between nations of a demanding and rigorous sort. National sovereignty has to be relinquished to an unprecedented extent. This willingness of the nations of the world to submit to this downgrading of their sovereignty for the common good is indicated (although not proved) by the unanimous approval of the charter for the International Atomic Energy Agency by the delegates of eighty-two nations. When and if the charter, complete with such provisions as internal inspection of a country and common pooling of fissionable material, is ratified, a highly significant step toward world order will have been taken. This is not to say that the loopholes in control described earlier will not remain. Nonetheless, a move of the nations of the world en masse, in response to a common challenge, cannot but leave a permanent imprint, and might develop into a lasting modus operandi.

Bound up with this whole matter is the great problem which includes all others: the creation of a world community with practical institutions strong enough to control national states. The control and development of nuclear energy may well be a means by which this ultimate problem is solved. As Paul-Henri Spaak has put it:

> "Out of our very extremity may come wisdom, out of the frightening means of destruction may come the means of assuring peace. What men in the past have sought to make prevail by persuasion, by appealing to humane feelings, may in the end be achieved because the insensate machine inexorably imposes it. If so, what an extraordinarily crooked road it would have been that led toward the good." 29/

The world may be, as Winston Churchill once put it, "looking over the rim of hell", but the chances of its going ahead and jumping in seems remote. The problem outlined in this paper is but an extreme extension of the overall nuclear dilemma the world has faced since 1945. And this in turn is but a major spurt in the headlong rush of technology that has confronted the world since the Industrial Revolution. And technology is but a part of the progress that has moved man forward from the primeval swamps.

The basic intelligence and fundamental high aspirations that

brought man this far will provide him with a workable solution to the nuclear dilemma. In "Can We Survive", his analysis of the next quarter-century, John von Neumann states:

> "The one solid fact is that the difficulties are due to an evolution that, while useful and constructive, is also dangerous. Can we produce the required adjustments with the required speed? The most hopeful answer is that the human species has been subjected to similar tests before and seems to have a congenital ability to come through, after varying amounts of trouble. To ask in advance for a complete recipe would be unreasonable. We can specify only the human qualities required: patience, flexibility, intelligence." 30/

During the years from 1942 to 1945, when only a few men knew of the tremendous new force unleashed from the atom, they often talked of the possibility that it might become a force for peace in the postwar world. Perhaps the atom as it spreads inexorably throughout the world may still serve as an instrument for demonstrating that international cooperation can work.

Chapter V
CONCLUSIONS

From the available evidence, outlined in the preceding chapters, it is concluded that the national security policy of the United States must be evolved in the light of the following facts or probabilities:

There is no stopping the spontaneous spread of nuclear know-how.

Spurred by energy shortages, atomic power reactors will be built in profusion throughout the world.

The diversion of fissionable material from peaceful atomic energy programs probably cannot be prevented.

Although the separation of weapons grade fissionable material from irradiated power reactor fuel is not an easy task for a lesser nation, it can be accomplished by any such nation which is industrially well advanced.

Using such material, a nation can easily and secretly make simple nuclear weapons, which thereafter can be securely concealed.

The above facts will result in the capability of ten to twenty nations, Free World and Communist, to manufacture nuclear weapons within about ten years.

The lesser nations will eventually get nuclear weapons also by transfer from their allies.

A small nation will probably not have a great number of weapons and it will be under restraints and limitations with respect to its ability to employ them.

Nonetheless, a nation possessing them will be in a much stronger power position than its neighbors, and this accretion of power will result in a corresponding lessening of power even among the major nations.

Nations with irresponsible or ambitious rulers are likely to use their nuclear weapons for aggressive purposes.

Situations of this sort will make small wars more probable; serious hostilities will be less likely to be held in check by the "nuclear stalemate" of the two major powers.

The broadening possession of such weapons by the Free World allies will make large wars, started by the U.S.S.R., less probable.

Identification of the initiator of a war or the perpetrator of a sneak attack may be an uncertain process.

The involvement of larger powers in the wars of smaller nations will be more probable, as the possibility grows of the smaller nations being able to upset the balance of power.

Paradoxically, because of inevitable rising awareness of the threat of nuclear war, the spread of nuclear weapons will probably be a major force leading toward international control of armaments.

The United States can best adjust to and exploit the above developments by:

A. Being the nation which helps the smaller nations with their nuclear development.

B. Creating awareness of the growing threat.

C. Sponsoring and supporting realistic arms control plans.

D. Pressing for the strengthening of the United Nations and the International Atomic Energy Agency.

E. Keeping its powder dry.

FOOTNOTES

1. Names Franck, et al, Social and Political Implications of Atomic Energy. (Report to the Secretary of War, June 11, 1945).

2. The President's Materials Policy Commission, Resources for Freedom, Vol. I, p. 129. (Washington: U. S. Gov't. Printing Office, June, 1952).

3. Statement of Louis Armand, Frantz Etzel, and Francesco Giordani, atomic consultants to the EURATOM countries, as reported by the Associated Press in the Washington Post, January 22, 1957.

4. David Shea Teeple, "America's Most Dangerous Experiment", American Mercury, (December, 1955), p. 11.

5. Verbatim Record of Conference on the Statute of the International Atomic Energy Agency, Remarks by Lewis Strauss (New York: United Nations Headquarters, Record of First Plenary Meeting, Sept. 20, 1956), p. 12.

6. The Proceedings of the International Conference on the Peaceful Uses of Atomic Energy reflect in the Record of the Conference the scope of the material presented. Thirty-eight of the seventy-three nations attending offered papers for presentation.

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8. Department of State Bulletin (November 5, 1956), p. 709. In these bilateral agreements the U. S. insisted on safeguards commensurate with those being incorporated in the IAEA charter.

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17. From the Summary of General Terms and Conditions Governing International Transactions in Special Nuclear Materials, reproduced in the Department of State Bulletin, (December 10, 1956), p. 929.

18. The President's Materials Policy Commission, Resources for Freedom, Vol. III, p. 39, (Washington: U. S. Government Printing Office, June, 1952).

19. Testimony of Dr. Arthur G. Hill, deputy director of Weapons System Evaluation Group, Department of Defense, before Senate Foreign Relations Committee, January 17, 1957.

20. The data in this section on nuclear progress around the world are a composite from the following sources: "French Atom", Barrons, March 5, 1956, p. 9; "The Atom at Work--How Soon? A Science Special Report" from Newsweek, (February 20, 1956), pp. 66-67; "Sighting on Atom's Golden Age", Business Week, (September 3, 1955), pp. 114-118; Gordon Dean, "We are in a Life and Death Atom Bomb Race", Look, (July 14, 1953), pp. 29-31; David Woodbury, Atoms for Peace, (New York: Dodd, Mead & Co., 1955), pp. 106-112; Bulletin of the Atomic Scientists, "News and Notes" column, 1952-1956 issues; E. W. Titterton, Facing the Atomic Future, (London: Macmillan & Co., 1956), pp. 130-45; Verbatim Records of the Conference on the Statute of the International Atomic Energy Agency, UN Headquarters, 1956.

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